What we claim is:

1. A process for optically transporting digital data over an all-optical long-haul communication path, comprising:

transporting digital optical data signals at a selected bit rate and a selected wavelength over a sequence of transmission spans including 70 percent or more of the spans of the long-haul all-optical communication path, each span being configured to have one or more local maximum optical power points at the selected wavelength on a transmission fiber thereof, the transporting causing a cumulative dispersion of each transported optical signal to evolve such that residual dispersions per span over some ones of the spans are positive and such that residual dispersions per span over other ones of the spans are negative;

wherein for each span, a primary local maximum power point at the selected wavelength is the one of the local maximum power points nearest to a signal input in the associated one of the fibers; and

wherein at the primary local maximum power point of each span of the sequence, magnitudes of cumulative dispersions of the digital optical data signals in pico seconds per nanometer are less than 32,000 times the inverse of the bit rate in giga bits per second.

2. The process of claim 1, wherein each transmission fiber is a non-hybrid optical fiber and each transmission span of the sequence includes a dispersion compensator cascaded with the transmission fiber of the same span.

3. The process of claim 1, wherein the transporting comprises transporting optical pulses in a pseudo-linear transmission regime.

4. The process of claim 3, wherein at the primary local maximum power point at the wavelength of each span of the sequence, cumulative dispersions of the digital optical data signals in pico seconds per nanometer are less than 16,000 times the inverse of the bit rate in giga bits per second.

5. The process of claim 3, wherein the selected bit rate is 20 giga bits per second or higher; and wherein a portion of the transmission fibers have lengths of 80 kilometers or more.

6. The process of claim 3, wherein the digital optical data signals are optical pulses.

7. The process of claim 3, wherein the dispersion map has a non-definite periodicity or is doubly periodic.

8. The process of claim 6, wherein a combined length of the transmission fibers of the optical communication path is 2,000 kilometers or more.

9. The process of claim 3, wherein the map is doubly periodic; and further comprising:

pre-transmission dispersion compensating each one of the digital optical data signals with a precompensation C_{PRE}; and

wherein $C_{PRE} = -N\underline{C_{RDPS}}/2 + (D/\alpha)\ln([1 - \exp(-\alpha L_{span})]/2) \pm 20\ \%$; α and D being the respective average power loss per unit length in the transmission fibers and the average dispersion in the transmission fibers; $\underline{C_{RDPS}}$ being an average of the residual dispersion per span over the spans of the path; L_{span} being an average length of said transmission fibers; and N being the number of transmission spans in a repeat unit of the doubly periodic map.

10. In a long-haul optical communication system for transmitting digital optical data signals at a selected bit rate and a selected wavelength; an apparatus comprising:

a sequence of optical transmission spans that form at least 70 percent of the spans of the long-haul all-optical communication path, each span of the sequence having a transmission single-mode optical fiber, an optical amplifier, and a dispersion compensator; and

wherein the path causes cumulative dispersions of the digital optical data signals to evolve such that residual dispersions per span over some ones of the spans are positive for the selected wavelength and over other ones of the spans are negative for the selected wavelength; and

wherein the path is configured to produce one or more local maximum optical power points for the selected wavelength in each transmission optical fiber, for the selected wavelength the local maximum power point nearest to the signal input of one of the fibers is the primary local maximum power point of the associated span; and

wherein the path is configured such that at the primary local maximum power points of the spans in the sequence, magnitudes of cumulative dispersions of the optical data signals in pico seconds per nanometer are less than 32,000 times the inverse of the bit rate in giga bits per second.

11. The apparatus of claim 10, wherein the dispersion map is one of a doubly periodic map and a map having a non-definite periodicity.

12. The apparatus of claim 10, wherein the transmission single mode optical fibers have positive dispersion.

13. The apparatus of claim 11 wherein a combined length of transmission fibers of the optical communication path is 2,000 kilometers or more.

14. The apparatus of claim 10, wherein the map is doubly periodic and the combined length of transmission fibers of the optical communication path is 2,000 kilometers or more.

15. The apparatus of claim 10, wherein each transmission fiber is a non-hybrid transmission optical fiber.

16. The apparatus of claim 11, further comprising the transmitter, the transmitter being configured to transmit optical pulses in a pseudo-linear transmission regime.

17. A long-haul all-optical communication system for transmitting optical pulses at a selected bit rate and a selected wavelength, comprising:

a sequence of spans forming 80 percent of the transmission spans of the all-optical long-haul optical communication path, each span of the sequence including a positive dispersion transmission optical fiber, an optical amplifier, and a dispersion compensator; and

wherein the path is configured to cause cumulative dispersions of the pulses to evolve such that residual dispersions per span are positive over some ones of the spans of the sequence and are negative over other ones of the spans of the sequence; and

wherein the path is configured to produce in each fiber one or more local maximum optical power points at the wavelength, each fiber having one or more segments where during operation a time-averaged optical power at the wavelength is at least 0.2 times the largest value along the same fiber for the time-averaged optical power at the wavelength, a primary one of the segments being such that an integral of a time-averaged optical power at the wavelength along the length of the primary one of the segments is greater than or equal to an integral of the optical power at the wavelength along the length of any other one of the segments for the same fiber; and

wherein the path is such that in said primary ones of the segments of the fibers of the sequence, magnitudes of cumulative dispersions of the optical pulses in pico seconds per nanometer are less than 32,000 times the inverse of the bit rate in giga bits per second.

18. The optical communication system of claim 17, wherein the path is such that in said primary ones of the segments of at least 90 percent of the fibers of the path, magnitudes of cumulative dispersions of the optical pulses in pico seconds per nanometer are less than 16,000 times the inverse of the bit rate in giga bits per second.

19. The system of claim 17, wherein the dispersion map is one of a doubly periodic map and a map having a non-definite periodicity.

20. The system of claim 18, wherein a combined length of the transmission optical fibers of the optical communication path is 2,000 kilometers or more.